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THESIS

VIDEOTELEDUCATION:
LESSONS LEARNED

by

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March, 1997

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VIDEOTELEDUCATION: LESSONS LEARNED

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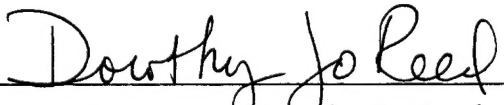
Author: 
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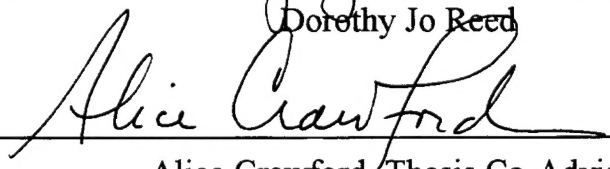
Approved by: 
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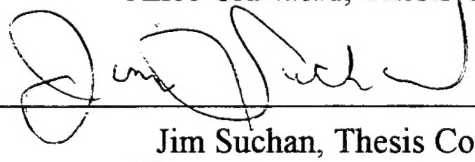
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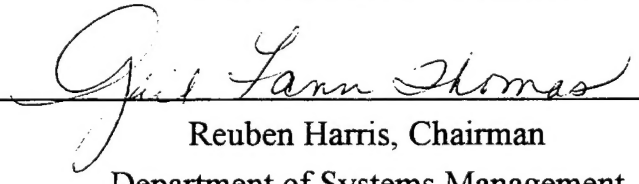
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ABSTRACT

Videoteleducation is a method of education and training that is occurring more frequently in corporate, military, and educational environments. VTE provides education and training to people who cannot or who prefer not to attend traditional educational institutions, to employees or companies who need timely information, and to those who seek cost savings for training widely dispersed groups of people. This study uses personal interviews of professors and trainers in both the military and cilivian sector and reviews the VTE literature to determine lessons learned from VTE. Results show that VTE causes changes in instructional design, physical, administrative and technological support, production facilities, and student/teacher preparation. The transition from a live classroom to VTE requires teachers to develop new skills and behaviors. Additionally, VTE saves costs and effectively delivers training as shown in studies of private corporations, federal agencies, educational institutions, and the military. However, VTE is not applicable to all courses and teaching methodologies. While researchers claim that VTE is effective, they often have not applied appropriate evaluation measures to their claims of VTE efficiency and effectiveness. Decision-makers should conduct thorough analyses and exercise caution before committing to a VTE program based on the claims in the literature.

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I. INTRODUCTION

A. DEFINITION

Videoteleducation, hereafter referred to as VTE, is a method of education and training that is occurring more frequently in corporate, military, and educational environments. VTE provides education and training to people who cannot or prefer not to attend traditional educational institutions, to employees of companies who need timely information, and to those who seek cost savings for training widely dispersed groups of people.

VTE uses television cameras, audio links and monitors to connect students and teachers who are not in the same location. VTE falls under the broad heading of distance learning which has been defined by the United States Congress Office of Technology Assessment as the "linking of a teacher and students in several geographic locations via technology that allows for interaction" (Cartwright, 1994). Distance learning encapsulates computer interactive distance learning, video and alternative delivery methods, traditional teaching methods, and use of the Internet as well as VTE and videoteletraining (VTT) (Markowitz, 1996). In fact, McGreal claims that

> Modern society is faced not only with the problem of fostering the development of new knowledge, but also of producing a workforce capable of adjusting to the information age. Distance education through modern technology can provide the means by which society can reach out to provide quality education to all members of society, wherever they may live. (McGreal, 1994)

Videoteleducation can create a "virtual reality" of being in the same room with people who may be thousands of miles away. Diamond and Roberts (1996) claim that videoteleconferencing allows the instructor to do virtually anything that he would do in an in-person classroom-- e.g., "hold discussions, create and display graphics, demonstrate products and more." (Diamond and Roberts, 1996)

B. HISTORY

Distance learning education has progressed through three generations. The first, which began over one hundred years ago, was characterized by correspondence courses. The second generation brought about open universities of the 1970s, which used correspondence, broadcast, and recorded media. The current generation is characterized not only by broadcast television/videotape with telephone interaction or with telephone, satellite, cable or Integrated Service Digital Network (ISDN) lines, but also includes computer conferencing networks and computer-based multimedia workstations. (Moore and Kearsley, 1996)

In September 1988, 45 university presidents from all areas and cultures around the world met in France and drafted a statement directed to two million researchers of higher education and sixty million students.

> In a world "that is plagued by war, hunger, injustice and suffering" the educators endorsed the exchange of information by communications based on relatively low-cost technologies that, they said, can provide access to computer networks and afford two-way television linkage among university classrooms in various part of the world, thereby creating a truly "global classroom" (Rossman, 1992).

Their goal was to increase understanding and research; and they encouraged universities to develop "regional centers" to aid in research organization, information and curricula exchange, and faculty development. Since that time, there has been an increase in universities collaborating with those of other countries. In the United States, the Corporation for Public Broadcasting said in 1987 that 50 percent of American colleges had telecourses for non-resident students (Rossman, 1992). The Telecommunications Act of 1996

> promises to level the playing field for cable operators, long distance companies and telephone companies to target new markets and partnerships for concentric growth. As a result of deregulation, high end networking services and offerings may be anticipated for educational applications in the near future Educational institutions on the other hand expect to gain improved bargaining strength and favorable terms in dealing with their phone companies (Hezel Associates, 1996).

As only one type of distance education, VTE can provide education to those for whom career demands, time constraints, personal family responsibilities, and physical accessibility are serious detriments to participating in traditional classroom learning environments. Using communications technology as a way to improve education "will be the most important single element in the next 20 years in terms of transforming higher education." (Schultz, 1996)

C. PURPOSE

The purpose of this thesis is to review lessons learned from VTE and to answer the following research questions:

1. What are the technological implications of this method of education?

2. Is VTE an efficient and effective method of learning?

3. What routine teaching practices must be changed when going from live classroom to video?

4. What has been your [a select group of NPS and DLI instructors and corporate trainers] experience with the medium?

5. What would you [select group] do differently in the future?

6. What would you [select group] recommend to others who are preparing to do it?

7. What are the lessons learned from VTE?

8. Are there any significant differences between corporate use of VTE and application in the military environment?

D. METHODOLOGY

1. Introduction

This research is based on a review of the literature and interviews. Research included reviewing books, technical reports, journal articles, periodicals, and the Internet. The interviews were conducted in 1996 with professors at The Naval Postgraduate School, Monterey, California, and the Defense Language Institute, Presidio of Monterey, and with trainers at Hewlett-Packard, MCI, and the University of Missouri, Kansas City. Results of interviews conducted by other researchers are also included.

2. Research Interviews

The purpose of the interviews was to gather descriptions of the experiences of the interviewees with respect to VTE. A memorandum with the research questions was sent to the interviewees a week in advance. The focus was on specific situations to procure accurate information. The goal was to see the research topic from the perspective of the interviewee and to understand how and why he or she thought a particular way about VTE. A cross between the qualitative research interview and structured open-response interview method was chosen in conducting the research interviews. (King, 1994) The research questions helped to maintain focus during the interview; however, open-ended questions were asked to enable respondents to identify the range of their experiences and the meaning of those experiences to them. The interviews lasted 30-60 minutes. All interviewees were assured of anonymity.

Analyzing the data from qualitative interviews necessitated keeping full transcripts, being familiar with them, listening to the interviews, and using the Miller and Crabtree editing approach. This approach entails searching for the meaningful segments, and , after cutting and pasting them, finding some common ideas. There was no formal hypothesis to test, and answers and opinions were not quantified. (King, 1994) The experiences from teachers and trainers combined with research from other sources provide comprehensive, understandable, and usable information to enable other instructors to become better prepared for their own VTE responsibilities.

3. Organization

This research is organized as follows. Chapter II focuses on the technology involved with VTE. Chapter III deals with measures of effectiveness. Changing requirements of VTE in regards to the instructional design, physical support, teachers and students are discussed in Chapter IV. Chapter V contains the conclusion and recommendations. Appendix A contains a handy checksheet, meant to be used as a quick reference guide, for those contemplating introducing VTE into their teaching environment. Appendix B lists where to go for more information. Appendix C lists sites that conduct VTE teacher preparation.

II. OVERVIEW OF TECHNOLOGY

A. INTRODUCTION

The purpose of this chapter is to briefly introduce some of the technological components of VTE systems. A general understanding of VTE technology will help decision-makers sift through researchers' reports and claims. Without this understanding, decision-makers may be misled because, according to the president of California State University at Monterey Bay, technology is at the "core of the way we do [education] business." (Schultz, 1996) Videoteleducation and videoteletraining by virtue of their nature involve technology. According to Diamond and Roberts,

> Industry analysts predict that by the end of the decade, videoconferencing equipment will be as fundamental an art of our working environment as the personal computer and the fax machine are today. And it promises to be just as revolutionary to the way we do business as the personal computer and the fax machine have been (Diamond and Roberts, 1996)

A brief explanation follows to explain basic components of a VTE system. This overview introduces some of the more common terms and systems found in the literature and is not intended to be a complete technical overview since technology is changing rapidly.

B. SYSTEMS SPECIFICS

1. Codecs

Codecs are hardware and software devices that convert audio and video images for transmission over telephone lines or satellites. After audio and video signals are generated at the broadcasting site, the codec converts them for transmission. Codec stands for coder-decoder-electronic device (Chadwick, 1995). When a teacher teaches in front of the camera, the camera records both image and sound, which are turned into digital information that is compressed by the codec. After the data are transmitted over

broadband telephone lines or satellite, the receiver site codec then decompresses the data into a television image at the remote site. (Goldstein, 1995; Diamond and Roberts, 1996)

2. Integrated Services Digital Network

Many organizations run VTE over Integrated Services Digital Network (ISDN) lines. ISDN lines link telephone systems together to form networks that transmit voice, data, and video simultaneously. The transmission capacity of data is called bandwidth, and ISDN is measured in bandwidth (Wolcott, 1995). Greater bandwidths can transfer information faster (Goldstein, 1995). The amount of bandwidth can vary from 128 kilobytes per second (kbps) to the newest speeds of up to 768 kbps (Compression Labs, 1996). The video compression that occurs in an ISDN system accounts for hesitations in sight and sound at the receiving end. The low carrying capacity of the ISDN lines is one of the criticisms of using ISDN (Filipczak, 1995).

Many organizations run their video over ISDN lines, which can carry more information than regular telephone lines but less than fiber optic cables. Most universities use ISDN because it is cheaper than using fiber optic cables. (Filipczak, 1995)

3. Fiber Optic Cable

A more expensive but higher quality method of transmission is fiber optic cable. Fiber optic cable has low susceptibility to noise, a low error rate, extremely high speeds (2 gigabytes per second compared to 64 kilobytes per second for ISDN), but high costs (Lewis, 1996; Day, 1994). Fiber optic connections are hair thin, flexible glass rods that use light signals to transmit audio, video, and data signals in either analog or digital format at greater speed than copper or coaxial cable (Chadwick, 1995). Companies with large training budgets use fiber optic cable as do teaching institutions that require demonstrations of sophisticated procedures, e.g., complex surgical operations (Filipczak, 1995).

4. Satellites

Video and audio signals may be transmitted via satellites. Transponders receive signals from a satellite dish, convert and strengthen them, then send them back to earth for conversion to digital form (Chadwick, 1995). Satellites can broadcast throughout the world and are expensive (Lewis, 1996). With VTE, the instructor goes to a local

television studio to conduct the training in front of a camera. The satellite receives the broadcast image, converts and strengthens the signal, then sends it to the receiver satellite at the remote site. There, students participate in the VTE instruction by watching it on a television monitor (Hunter, 1995).

5. 1-way video/2-way audio and 2-way video/2-way audio

There are two basic types of VTE systems. One is a 1-way video/ 2-way audio system, and the other one is a 2-way video/ 2-way audio system. With the 1-way video system, the students can see the teacher, but the teacher can only hear the students through microphones placed throughout the classroom. With the 2-way video system, students can see the teacher; teachers can see the students, and sometimes students in one location can see students in another location. With the 2-way video/2-way audio system, the teacher can hear the students' questions through the voice-activated microphones and see them on the video monitor. Although not an exhaustive list, some of the components of both 1 and 2-way video systems are:

- Television cameras with zoom and wide angle lenses, power supply, pan and tilt unit, remote control and mounting brackets
- Audio/video switcher and modulator
- Distribution amplifier
- Video monitors
- Video visualizer and light box
- Microphones, speakers, mounts and audio brackets
- Computer and fax machine
- Teacher console, student stations
- Cable, connectors, adapters, plug and patch cords (Day, 1994).

Researchers disagree over which system is more effective for learning. Garg stated that a system that uses satellite-based Wideband Video Transmission System (WVTS) with Digital Satellite Compression (DSC) techniques is effective for training

delivery (Garg, n.d.). The instructor using this system controls the audio and video vehicle delivering the training. DSC is a 1-way video/2-way audio system.

Researchers often mentioned the One Touch Viewer Response system when discussing effective 1-way video/2-way audio systems. The system has two parts, one for the teacher, another for the students. Although the instructor cannot see the students, he or she exercises classroom control by calling on specific students, controlling the multimedia [other cameras and videotapes], and monitoring student comprehension. The teacher's touch screen provides this control (Shields, 1995). The students each have a Response Keypad that enables them to log in personal data, answer yes/no and multiple choice questions, and call the instructor (Shields, 1995; Garg, n.d.). The instructor can display quiz questions on the monitor, and the students can respond via the keypad. Students can instantly see their responses, which are flashed on the monitor as they respond. This enables both students and teacher to see results immediately (Garg, n.d.). The Phone Controller controls incoming student telephone calls, which eliminates the need for a switchboard operator (Garg, n.d.).

Researchers who exclusively use the One Touch system claim that its most important feature is that it offers interactivity between students and professor due to the student response keypad. (Markowitz, 1996; Lewis, 1996)

III. EFFECTIVENESS MEASURES

A. INTRODUCTION

There is a growing body of research available on VTE effectiveness. Most of the literature claims that VTE is effective, yet researchers often do not state how they measured that effectiveness. What literature there is on VTE effectiveness focuses on several issues: cost effectiveness, student learning experiences, learning outcomes, teaching effectiveness,and interactivity. This chapter examines these issues and describes reports of VTE effectiveness claims (some of which were not substantiated by specific quantitative data.)

Researchers' evaluation of VTE effectiveness differs, and they often are not clear on how they evaluate it. Also, many researchers do not differentiate among the terms videoteleducation, videteletraining, videoteleconferencing, and distance learning. This adds to confusion in evaluating effectiveness studies. Researchers also use the term "interactivity" freely and, except in one instance, do not define it. Consequently, decision-makers should look objectively and critically at VTE effectiveness claims.

Clark states that one should differentiate between delivery technology and instructional technology when evaluating for effectiveness. Examples of delivery technologies are books, computers, and teachers; while examples of instructional technologies are the ways to structure lessons and their sequence by using examples, practice, and tests. (Clark, 1994)

Researchers evaluate programs differently. Wagner states that researchers can use formative or summative processes on program evaluation and student assessment. The processes address a multitude of areas, e.g., student and instructor attitudes, effectiveness of the technologies, effectiveness of teaching techniques, comparative effectiveness of different models of tracking student performance, faculty evaluations, effectiveness of testing techniques, technology system reliability, and cost-benefit determinations. (E. Wagner, 1993)

One technical report challenges current VTE research by highlighting that, "VTE studies have often unwittingly appropriated the mental model of learning as information transfer to guide their research designs and their measures of effectiveness" (Suchan and Crawford, 1995). The report recommends that measures of effectiveness should be

ascertained differently. Suchan and Crawford recommend bringing an awareness to both administrators and instructors about their own mental attitudes concerning learning and teaching methodologies (Suchan and Crawford, 1995).

With these issues in mind, decision-makers must be aware of generalizations and claims that are unsubstantiated by objective measurement criteria. Caution should be exercised before committing to a VTE program based on the claims found in the literature.

B. COST EFFECTIVENESS

1. Introduction

VTE is efficient from a cost point of view when an organization derives training benefits and saves training dollars. So, researchers should not ignore cost data in effectiveness studies. Some studies show that costing out two or more methods of instruction is a way to compare VTE effectiveness (Clark, 1994). The Mitre Corporation lists some cost factors that could be included in a study. They are: license fees/ purchase costs, salaries for instructors and support personnel, expenses for student support, video production, transmission, recording, travel, other direct costs (The Mitre Corporation, 1995).

Two major challenges concerning effectiveness that face the distance learning [VTE] industry are finding a cost-effective method and finding a method that facilitates interactivity among students and teachers. In light of these challenges, Garg states

> First is the provisioning of a cost-effective solution to train a large number of geographically dispersed students without incurring travel and living costs. Second is the creation of a classroom environment on a telecommunications medium offering personal interaction between the instructors and the students. (Garg, n.d.)

2. Travel Costs

Most research into cost effectiveness discusses savings that result from eliminating travel and per diem costs. In teaching situations that involve widely dispersed personnel, an organization incurs two types of costs: those due to travel costs and those due to loss of production. (Wetzel, Radtke, and Stern, 1994)

Some large organizations claim to have saved considerable training dollars with VTE. Apple, Chrysler, Shell, Xerox, Ford, Hewlett-Packard, and the US government have increased employee retention, cut learning time, and cut overall costs through the use of VTE. (Goldstein, 1995) Citicorp conducts training meetings via VTE to introduce new products to seven sites in the US and saves hundreds of thousands of dollars. (Goldstein, 1995)

AT&T tracks cost effectiveness and uses a model to track student expenses. Although the research did not state whether a 1-way video or 2-way audio system was used, AT&T has saved more than $20 million in travel costs by using VTE. (Thompson, 1994)

Kaiser Permanente in Northern California found that VTE allows doctors to save commuting time of an hour per doctor. VTE technology has saved $650,000 a year on travel costs. Now that they have implemented VTE, trainers claim an even greater savings of $1,500,000. This savings is the result of additional travel savings from doctors who did not formerly participate in the training due to travel requirements. (Goldstein, 1995)

The FAA achieved productivity gains between $1305 and $6353 per student as a result of VTE. [Garg did not report how the FAA measured productivity.] The FAA uses the One Touch System because it forces interactivity on the students (Filipczak, 1995). The FAA also did a demonstration of Interactive Videoteletraining (IVT) to validate technologies and identify lessons learned. They found that IVT/VTE is feasible for teaching large numbers and that, while reducing travel and per diem costs, IVT can test and train people who are geographically dispersed. (Garg, n.d.)

The Department of Energy also uses VTE. Trainers discovered that that they saved $1.5 million in the first two years of using VTE which was a 90 percent decrease in travel costs. (Lewis, 1994)

The United States Department of Defense has achieved economies of scale through the use of VTE. Although the authors did not specify what VTE system was used, they stated that US Navy training courses and conferences conducted from 1989-1994 saved $7,154,000 in travel and per diem costs. There are additional cost avoidance dollars of $386,000 for the same time frame. Additionally, the US Air Force saved $5 million from 1992-93 by using VTE. (Moore and Kearsley, 1996)

Wetzel reported on a 1990 study by Rupinski and Stoloff concerning a Navy satellite videoteletraining system with 2-way video/2-way audio. Although researchers did not specify by how much, they found that the operating budget for VTE cost less than that

which would have come from traditional training (with its travel and per diem costs). (Wetzel, Radtke, and Stern, 1994)

A Navy Personnel Research and Development Center (NPRDC) study compared VTE (between San Francisco and San Diego) to per diem and travel costs for both instructors and students using traditional face-to-face instruction. Results showed that VTE was less costly than either sending an instructor to a remote site or having students travel to the instructor. Researchers did not state cost savings in percentages or dollars. (Wetzel, Radtke, and Stern, 1994)

Not all VTE cost effectiveness studies show that VTE saves costs. The Naval Training Systems Center conducted a research project on VTE for Naval Reserve programs. Researchers performed a cost analysis on 1,204 courses of instruction that Naval Reserve personnel took in 1989. Among these, 44 courses were identified as candidates for VTE. Researchers looked at cost-avoidance and savings versus sending Selected Reservists to traditional training sites (Sheppard et al., 1991). They performed a cost analysis for each of the technical alternatives to compare the estimated costs of delivering the proposed courses using VTE with current Naval Reserve training travel/ per diem costs. Researchers concluded that they could not justify VTE to save costs. (Sheppard, Hassen, Hodak, Swope, Denton, 1991)

A problem with this study is that researchers did not consider that the Reserves could use active duty VTE systems already in place. They thought that a more complete analysis could lead to other conclusions about cost effectiveness. Also, travel and per diem costs may have been exaggerated. (Sheppard et al., 1991)

CNET states that the benefits with VTE/VTE are: homeport training, effective and consistent training, improved quality of life, instructor multiplier, higher unit readiness, substantial return on investment, e.g., savings are greater than $10 million from TAD costs, and a way to meet emerging needs to save money. CNET also leases equipment because technology is changing rapidly. (CNET lecture, 1996)

3. Production and Equipment Costs

Production and transmission costs affect overall costs. VTT systems consisting of 2-way video/ 2-way audio are "noted to be significantly more costly than 1-way video systems where audio talk-back can be more economically accomplished by using regular phone lines." (Wetzel, Radtke, and Stern, 1994)

Wetzel also studied the Army's teletraining network (TNET), which uses a leased 2-way video/2-way audio system. Wetzel found that leasing the TNET system contributed to a cost increase. He found that organizations can decrease large initial fixed costs by sharing equipment, facilities, and communications network access, and developing understanding with consortiums or public broadcasting organizations. (Wetzel, Radtke, and Stern, 1994)

Researchers from NPRDC have conducted extensive research into VTE. In one study, courses in Celestial Navigation, Navy Leadership (NAVLEAD), Fiber Optic Cable Repair, and Quality Assurance were evaluated (Wetzel, 1995). Researchers recommended that CNET consider the use of VTE for NAVLEAD because of potential cost savings but should research new ways of fostering interactivity between students and teachers (Wetzel, Simpson, Seymour, 1995). Researchers concluded that all these courses can be taught effectively via VTE (Wetzel, 1995).

4. Costs per Number of Participants

The costs of distance education using VTE decrease as the number of participants receiving training increases. When compared with the per student costs of students who reside on a typical college campus, researchers found that investment in VTE systems incurs equal or less costs. (Wetzel, Radtke, and Stern, 1994)

Another Navy cost analysis showed that providing specialized courses with 2-way video/2-way audio in areas where there are relatively few students is not generally cost efficient (Wetzel, Radtke, and Stern, 1994). Bramble noted that courses using 2-way video/2-way audio are cost effective if they are conducted more than once and if different courses are conducted each month (Bramble et al., 1994).

NPRDC conducted cost effectiveness research and cited McCabe's 1979 report that stated costs per VTE student were approximately 40 percent of costs for traditional students per course. The researchers stated that

> Economic studies of distance education indicate that its per student costs are comparable with or less than the per student costs of conventional campus-based college. Costs per graduate tend to be less favorable because . . . populations are often less degree oriented than conventional education populations. (Wetzel, Radtke, and Stern, 1994)

Wetzel stated that Kiesling's 1979 study found that in the case of large lecture-hall courses common in undergraduate curricula, VTE could reduce per student costs by 20 to 30 percent in relation to traditional instruction costs. The study compared open universities (who use VTE and other distance learning technologies) to traditional universities. (Wetzel, Radtke, and Stern, 1994)

The Florida Teletraining Project assessed whether VTE could be used to deliver some Army courses. TNET provided the communications technology. The project studied how to use community colleges to deliver training on 2-way audio and 2-way video for administrative, supply, military police subjects, hazardous waste (HAZMAT) and Total Quality Leadership (TQL) courses. Results showed that training was effective and students had positive perceptions of the training. Also, the VTE system proved to be reliable. However, the negative result was that VTE was more expensive than resident training. (Bramble et al.,1994)

5. Summary of Cost Effectiveness Studies

Cost-effectiveness studies focus on VTE effectiveness from a cost savings perspective. VTE saves dollars mostly due to reduced travel and per diem costs. Production and equipment purchase and rental costs must be factored in when assessing cost effectiveness as well. Economies of scale produce savings with VTE. Trainers should examine their own training needs and perform a cost analysis before committing their organization to VTE.

C. STUDENT LEARNING EXPERIENCES

1. Introduction

One central issue of VTE effectiveness concerns student learning. Research interviews with experienced teachers revealed that there needs to be an understanding of all issues involved in VTE besides technology, course description, and costs. While other studies may show VTE to be an efficient method of training, the medium cannot be considered effective if the students do not learn.

The attitudes and expectations of the student also influence their ability to learn. Some researchers state that students' learning experiences and attitudes result more from the content of the delivery than the medium used (Clark, 1994; McGreal, 1994; The

Mitre Corporation, 1995). Horn found that the student's attitude must be one of increased responsibility and more independent work since VTE keeps them removed from direct teacher involvement (Horn, 1994).

2. Instructor Concerns

Interviews with professors at the Naval Postgraduate School and DLI revealed they have concerns about whether the students are learning as well with VTE. One interviewee commented that "We need to be thinking about the pedagogical problems. The biggest concern is if we get invested in distance learning only to find out that the learning experience isn't good enough." (Interview, 1996)

Bramble's research with VTE compared the relative achievement of groups of students who had received training in the same subject from different media. The researcher found that VTT appears to be acceptable, reliable, and effective when evaluating students' performance on standard military proficiency tests. (Bramble et al., 1994)

Other researchers found training via VTE to be just as effective as face-to-face instruction (Filipczak, 1995; Hunter, 1995). AT&T found that not only is teletraining a very effective method of instruction for its employees, but students learn well (and perform well) if not better from VTE than from face-to face instruction. The same researcher also found that the students' perceptions of courses taught via VTE and those taught face-to-face are that both methods are equally effective (Thompson, 1994).

Moore and Kearsley state that,

> the weight of evidence . . .points overwhelmingly to the conclusion that teaching and studying at a distance, especially that which uses interactive electronic telecommunications media, is effective when effectiveness is measured by the achievement of learning, by the attitudes of students, and by cost effectiveness. (Moore and Kearsley, 1996)

The authors warn, however, that much of their evidence is anecdotal and that many distance education researchers have limited resources at their disposal. They claim that the research lacks a theoretical framework and, therefore, question the effectiveness of much distance learning research. (Moore and Kearsley, 1996)

3. Learner Attitudes and Expectations

The attitudes and expectations of the learner influence the effectiveness of VTE and learner attitude can depend on the type of student. Mercer states that if the course is being taught to executives, they demand less lecture format and more interaction (Mercer, 1995). Researchers suggests three issues that affect student attitudes:

> - Educators are concerned that students do not have personal contact with teachers
>
> - A large class size can create problems
>
> - Students cannot interrupt with questions, be involved in discussions, and get help from teachers. (Wetzel, Radtke, and Stern, 1994)

To help decrease these problems, researchers found that the instructor needs to communicate to the student what is expected of them in the VTE environment. (Wetzel, Radtke, and Stern, 1994 ; Interview, 1996; Markowitz, 1996; Lewis, 1996)

Television can also pose problems in the area of learner attitudes and expectations. Sometimes students have expectations of being entertained while sitting in front of a television. With VTE however, once the teacher starts asking questions of the students, the student must become involved in the learning, and their expectations must change. (Mercer, 1995) Due to the similarities of VTE to television watching, Wetzel raised concern that for students

> Television is a nonserious or an 'easy' medium because of its visual and 'realistic' format. . . [and] likely to result in students making less conscious efforts to learn from television than they would from a more 'demanding' medium. (Wetzel, Radtke, and Stern, 1994)

However, after reviewing other studies, the researcher concluded that, "The negative effect of exposure to commercial television appears to be less pronounced than is popularly believed" (Wetzel, Radtke, and Stern, 1994). Their research shows that TV's impact on achievement is small, negative, and varies (Wetzel, Radtke, and Stern, 1994). While students who watch the least amount of television are benefited the most by VTE, researchers found

> The impact of commercial television on the ability to learn from televised material is relatively small. . . .Television is generally considered to be undemanding compared to other learning media. (Wetzel, Radtke, and Stern, 1994)

Clark recommends using participation reaction to the training and achievement of program objectives as a means to evaluate VTE effectiveness. He found that if students expect a new medium to make learning easier, they will not try as hard. Clark recommends evaluation plans that are based on experience of those who have worked with VTE. He also recommends that delivery and instructional evaluation be separated when determining effectiveness. (Clark, 1994)

Students go through an adjustment period with VTE. Some of the student reactions to VTE include: the need to learn new acronyms and vocabulary, the importance of using electronic mail (e-mail) to communicate, and adjustment to the less structured environment. According to Ittelson,

> Those students with higher motivational levels worked through the confusion and newness of collaboratively sharing and learning with a group of people they did not know and discovered he endless opportunities and rewards of these new mediums. (Ittelson, n.d.)

McGreal reviewed literature about student attitudes towards courses taken face-to-face or through teleconferencing. He found that student attitudes are "generally positive" and that the media chosen cannot be shown to influence their attitudes. McGreal added that students on telecourses do as well as those who have live teachers and have positive attitudes towards the experience. (McGreal, 1994)

4. Music, Sound Effects, and Humor

Effectiveness studies have also examined the content of material and the use of sound effects, music, and humor in the teaching environment. Wetzel found that

> specific visual and sound effected purely to attract the viewer's attention to the program . . . [and] . . . had limited success in most studies and has been discouraged by most general commentators on the research literature since the 1950s. (Wetzel, Radtke, and Stern, 1994)

They found that video sound effects and music had inconsistent or small positive effects on learning and instructional effectiveness of a video or film presentation (Wetzel, Radtke, and Stern, 1994). In addition, studies from the 1930s revealed humor not to be an effective tool within the classroom or within a television production (Wetzel, Radtke, and Stern, 1994). Another researcher agreed that humor is not usually effective in the VTE environment (Lewis, 1996).

D. LEARNING OUTCOMES

From the aerospace industry through telecommunications, VTE is a method to provide just-in-time training, save considerable training costs, and achieve learning. A 1996 Industry Report in *Training* surveyed US organizations with over 100 employees. The report found that of all the instruction methods used, VTE comprises only 18 percent of training methods. (However, there was only a 14 percent response rate on the surveys.) (*Training*, 1995)

Many organizations state that VTE has been an effective training medium although, in many cases, effectiveness claims were neither substantiated nor were evaluation methods discussed. The following organizations claim VTE has been effective for them.

1. Aerospace

The aerospace industry is a large consumer VTE. Boeing uses it in product development by bringing developers and planner together at frequent intervals. United Technologies Corporation uses VTE to increase productivity of people and shorten development time. The Unisys Corporate Technology Division trains senior technologists and engineers through VTE. (Goldstein, 1995)

2. Automobile Industry

Research shows that the US automobile industry has moved heavily into VTE as a training method for dealers and mechanics (Goldstein, 1995). By closing six of its 30 regional training centers in 1986, General Motors was able to take advantage of regional vocational technical schools around the United States by using VTE (Hequet, 1988). According to a source at Chrysler Corporation, cost estimates for implementing VTE

have been around $500,500, which they consider steep but which will bring substantial benefits in the long run (Hequet, 1988).

When the Honda Acura came out in 1986, the American Honda corporation outfitted all Acura dealerships with interactive video workstations so that technicians could have immediate access to new techniques. This enabled Honda, with its own corporate training centers using interactive video, to schedule immediate training for mechanics who need to learn without having to wait for the appropriate training course. Honda's manager of service training and development with Los Angeles-based American Honda Motor Co. stated, "We've stopped focusing on teaching and started focusing on learning" (Hequet, 1988).

In 1986, the Dallas-based Automotive Satellite Television Network (ASTN) set up training on a local TV station. After only 2 years, ASTN had 4000 dealerships participating and was adding 200 per month. It provided 30 minutes of training per day for the mechanics who did not have to leave their workplace. (Hequet, 1988)

3. Educational Institutions

Educational institutions use VTE and claim that it is an effective medium. The Wharton School of Business and Dartmouth College use a network called EXEN. The program has 15 of the schools' best instructors bring training to large corporations like Chevron and Motorola by teaching business management educational theories (Lewis, 1996). Students at California State, Chico realized that although there were initial challenges, VTE provides educational benefits (Ittelson, n.d.). Oregon State University has a VTE satellite clearinghouse for information communicated through an educational satellite system called "ag*sat" (Hunter, 1995). The University of Missouri uses VTE extensively and also provides a Satellite Educational Programming Guide. The guide includes courses in business, general interest, distance education, continuing education, professional development, and technology (Hunter, 1995; Brenneman, 1996).

There is at least one distance education program in every state according to a study conducted at Ball State University's Center of Information and Communication Sciences (Horn, 1994). The University of Michigan Business School conducts executive education through a global Master in Business Administration (MBA) program (Mercer, 1995). The University of North Carolina at Wilmington uses videoteleconferencing to project to a 16-county area of the state (Schultz, 1996). The University of Delaware has

a program that involves 28 academic departments. It produces almost 100 distance learning courses, including interactive television, and provides two degree programs with a student enrollment of 1,722 over 12 states. (Fisher, 1996)

The incorporation of VTE into college-level education does not always proceed smoothly. The University of Maine had problems caused by its efforts to get an independent distance learning institution. Whereas the Chancellor said the faculty had misconceptions about distance learning, the faculty claimed the administration was "riding roughshod" over them. Faculty members were unhappy that they had not been consulted on the issue. A representative quoted from the National Education Association said, "The faculty are the experts in their discipline and should be a party to this [starting VTE]." (DeLoughty, 1995)

4. Federal Agencies

Research shows that federal agencies also claim that VTE is effective. With VTE, the FAA instructor can break the training materials into different modules, which are then broadcast to the students over a period of time. This contrasts to forcing the student to try to absorb everything within an 8-hour period. (Filipczak, 1995)

5. Hewlett-Packard

One of the largest companies to implement VTE is Hewlett-Packard (HP). As of 1995, HP had delivered over 500,000 student hours of training and education via live interactive distance learning (Lewis, 1995). All sales representatives can access 300 field technical engineers every month and interact directly with laboratory engineers to facilitate "just-in-time learning" (Lewis, 1995). This has enabled HP to reduce product time-to-market by 35 percent (Goldstein, 1995).

6. Medicine

VTE is used in the medical field as "telemedicine." Massachusetts General Hospital in Boston uses VTE when working with medical clinics in the Middle East for consultations. Telemedicine allows rural doctors to access the medical expertise of university doctors who have the latest technology and equipment. They can get information and share knowledge through VTE rather than traveling to the universtiy

hospital. This saves time, helps doctors network, and increases the quality of care for the patient. (Goldstein, 1995)

7. Telecommunications

Telecommunications companies like AT&T and MCI are huge providers and users of VTE. They and local companies in US and Europe sell videoconferencing as a telecommunications bundle for business customers (Judge and Reinhardt, 1996). Over a 10-year period, AT&T has delivered the "latest work on new telecommunications products, services, and applications to more than half-million AT&T employees around the world" (Lewis, 1996).

AT&T National Teletraining Center has established a statewide teletraining network that trains its sales and technical employees. Trainers use a three-level method to evaluate effectiveness. This includes student reaction to the particular course via a questionnaire, a multiple choice test, and a training effectiveness survey. Trainers found that teletraining is highly effective and that student achievement is as good and sometimes better than achievement in face-to-face instructional situations. The students, whose achievement shows through on-the-job performance, perceive the VTE courses to be just as effective as live classes. (Thompson, 1994)

The Director of the Alternative Delivery System for the MCI Career Enhancement University says MCI now conducts 80 percent of its courses via VTE. Regarding effectiveness, MCI trainers have found that students do as well if not better with VTE as indicated by of a 13-17 percent increase in retention of material. They claim that retention remains as high even after accounting for the newness and novelty of the training experience. All students take tests following coursework and then again 30 days later to determine the effectiveness of the training. (Markowitz, 1996)

8. Military VTE Effectiveness Studies

a. Army - Defense Language Institute (DLI)

The Defense Language Institute (DLI) at the Presidio of Monterey educates 3,000 students per year in international languages. Since the students have been through resident training for initial language learning, VTE is used for refresher training only. The research interviews revealed that teachers can do anything on VTE that they

would do in a live classroom and still achieve a high level of effectiveness. Effectiveness is measured through test results and ability to speak and write the language. (Lellos, 1995)

DLI educators found that students learn faster through VTE due to having intense instruction periods with no unused time (dead time) in class. This intensity requires that the instructors prepare well and include interactive periods. (Lellos, 1995)

DLI broadcasts to remote classes of under 15 students. No local students participate during lessons conducted via VTE. A technical facilitator is always available at each remote site. One professor felt that the students did as well, if not better, than live classes due to not having to speak directly to a live professor; i.e., that the distance resulting from VTE helped build students' confidence to speak the language. (Interview, 1996)

b. Army - Satellite Education Network (SEN)

The Army Logistics Management College uses a 1-way video 2-way audio system with its Satellite Education Network (SEN) that in 1994 broadcasted to 13,000 students at 71 sites (Moore and Kearsley, 1996). Researchers found that SEN is effective when used to teach acquisition management, logistics support, logistics operations, and related courses. SEN uses 4 hours per day of broadcast time and uses a closed network with a single satellite uplink and 71 downlinks throughout the US. Student opinion ratings were slightly lower than for equivalent resident courses, but examination scores did not differ significantly between VTE and the equivalent resident courses. (Pugh et al., 1992)

c. Army - Reserve Training

VTE research conducted at the US Army Training and Doctrine Command (TRADOC) at White Sands Missile Range studied training effectiveness of 1-way and 2-way video VTE for Kentucky Reserve Component soldiers taking the Basic Noncommissioned Officer's Course. Researchers found that money is saved because VTE reduces the amount of time students spend in resident instruction. Other benefits of VTE were allowing the students to remain in their home area, providing team training without travel requirements, providing individual and group feedback, giving standardized instruction, and keeping instructors in one place. (Lehman and Kinney, 1993)

An important discovery from this research was the difference between 1-way and 2-way video. Soldiers who were trained with 1-way video had significantly higher post-test scores than soldiers who were trained by either 2-way video or by traditional instruction using traditional course materials. (Lehman and Kinney, 1993)

Researchers explained that 2-way video was not as effective as 1-way due to the differences in the training method and not other factors. The researchers had no clear reasons why this was so. Other needs arose from the study: the need for technical support during the drill weekends and the need for a site coordinator. They found that technical problems occurred frequently during training due to lack of technical support. (Lehman and Kinney, 1993)

d. Navy Personnel Research and Development Center (NPRDC)

An extensive NPRDC study reviewed 13 systems in public educational institutions, private industry, and the military to accumulate lessons learned with VTE. The systems used different types of transmission media (e.g., satellite, land line, microwave), analog and compressed-bandwidth digital transmission, and 1- and 2-way video. Students were high school, university, business executives, or military enlisted personnel. The method used was a comparison between live classroom and VTE. Although some students complained about audio quality, most students had positive reactions to VTE. Test results showed no significant differences in scores between live students and remote students. Learning outcomes were measured through tests in some cases and not cited in others. (Pugh et al., 1992)

Wetzel, Radtke, and Stern did an extensive literature review using the National Technical Information Service, the American Psychological Association, and the Educational Resources Information Center. The researchers found VTE to be as effective as conventional instruction. They found that students in a VTE environment perform comparably or only slightly less well than those in a live student environment. They also found that effectiveness can decline with too many sites and students. (Wetzel, Radtke, and Stern, 1994)

NPRDC researchers found that in the case of teaching NAVLEAD to division officers:

> The use of VTT forced trainers to make compromises in terms of factors that the Navy leadership community has valued: instructor-student and student-student interaction were reduced, the intensity of the learning environment and ability of instructors to perceive remote students' nonverbal cues were lessened by the limited view offered through the VTT system, and some experiential learning experiences were made more difficult to conduct with VTT. (Simpson, Wetzel, Pugh, 1995)

e. Navy Electronic Schoolhouse Network (NESN or CESN)

The Navy created the Navy Electronic Schoolhouse Network (NESN) under the command of CNET and refers to it as either NESN or CNET Electronic Schoolhouse Network (CESN). CESN has a number of initiatives among which VTE is just one. CESN links 16 sites and 22 classrooms. Each classroom costs $75,000. A prototype study of the system ran from fiscal year 1993 through fiscal year 1996 and used 2-way audio and 2-way video. Broadcasting averaged 10 hours per day, 5 days a week on leased equipment. Courses were primarily lecture-based. Classrooms are located on the east and west coasts, Great Lakes, Ingleside Texas, Pearl Harbor, Bethesda, MD and the USS George Washington. (CNET, 1996)

CNET has also concluded overall that VTE improves training capabilities by letting sailors spend time in their homeport and increasing QOL. CNET claims that readiness will be negatively impacted in the long run if VTE is not implemented. (CNET, 1996)

g. Naval Postgraduate School

Regarding VTE and postgraduate education, the Naval Postgraduate School (NPS) in Monterey has been using VTE since 1994. NPS began a pilot program to bring Systems Management courses to a helicopter squadron stationed at Naval Air Station North Island. Other courses taught from NPS departments include: software engineering, digital signal processing and communications, information technology management, fundamental management courses, short courses in executive management education, healthcare management for hospital managers and a computer technology course. Between July 1994 and June 1996, 350 students in 4 departments (Aeronautics

and Astronautics, Electrical and Computer Engineering, Computer Science, and Systems Management) have taken courses broadcast from NPS via VTE. (Honegger, 1996)

Researchers have concluded that continued and expanded use of VTE at NPS could give more opportunity for all military officers to have graduate education. Introductory courses done via VTE could shorten residence requirements. As VTE reduces officer residence time in Monterey, it allows officers to stay competitive within the operational environment. (Koczela and Walsh, 1995)

There are other benefits. The Department of the Navy (DON) could incur cost savings as officers stayed operational and took courses via VTE in the evenings. The mission of NPS would change and NPS would increase in its overall value to DON. Research showed that Naval Postgraduate School can be the "Navy's Distance Education University," and some NPS professors agree. (Koczela and Walsh, 1995)

E. INTERACTIVITY: THE KEY TO EFFECTIVENESS

1. Definition of Interactivity

Interactivity is the ability for people to mutually influence each other. It is further defined by some researchers as a

> medium's ability for senders and receivers to notice and respond to each others' communication cues. There are verbal and non-verbal components to interaction: language, speech rate, voice pitch and intonation, eye contact, proxemics (use of space), gestures, and body language in general. . . . Feedback is a subcategory of interaction. (Crawford and Suchan, 1996)

All but one VTE study used the word "interactivity" without ever defining it, which can cause misunderstandings and misinterpretations of effectiveness claims.

2. Introduction

Interactivity is a core issue that impacts VTE effectiveness (Lewis, 1996; Markowitz, 1996; Bramble et al., 1994; Wetzel, Radtke, and Stern, 1994; HP Video "Breaking the Barriers," 1993). Researchers found that the higher the interactivity and broadcast fidelity, the higher the overall effectiveness and satisfaction with the teaching

method (Wetzel, Radtke, and Stern, 1994). Most studies did not look at interactivity per se, but noted that without it, VTE effectiveness diminished. An understanding of what interactivity is and how to increase it helps the trainer prepare for VTE. Wagner states

> The literature of learning and instructional theory indicates that when students are active participants in the learning process, they are likely to perform better and remember more. (E. Wagner, 1993)

Focusing on methods that promote interactivity positively impacts training effectiveness. Researchers found no decrease in student achievement at remote sites compared to local students because of teacher emphasis on interactivity. This resulted in increased effectiveness and satisfaction (Wetzel, Radtke, and Stern, 1994). Educators have found that "promoting interaction will become increasingly important on residential campuses" (N. Wagner, 1996). According to Horn, researchers need to change their assessment tools "to reflect the effectiveness of interactivity as well as the interactivity levels that are necessary components of effective instruction" (Horn, 1994).

Generating interaction among students is challenging in the VTE environment. Interviewed professors noted two ideas relating to interactivity. The first is that teacher to student interaction is always important. The second is that student to student interaction is extremely important especially in an executive learning environment. In a live classroom situation, the professor can direct the students' eyes to each other and can walk around the room to orchestrate student interaction VTE does not allow for this mobility. (Interview, 1996)

To achieve learning outcomes that required highly interactive, dynamic classes, the teacher has to ensure interactivity in order to keep the remote sites involved in the learning experience (Mercer, 1995; Lewis, 1996; Markowitz, 1996). Bramble has shown that, "In classrooms with higher levels of interaction, students have higher levels of achievement and more positive attitudes" (Bramble et al., 1994). Albrektson found that the more the students interacted with each other, the more they started to accomplish as individuals. "They were going beyond absorption of information and were actively synthesizing it with their understanding of the present" (Albrektson, 1995).

3. Include Interactivity to Increase Effectiveness

Increasing interactivity can involve many activities. These activities are: using 2-way communication, mandatory VTE orientation sessions, phone check-in assignments at certain intervals, optional on-campus study sessions, encouragement of peer support, and spot phone checks to students. Interactivity is increased by eliminating the causes of poor interactivity. Some of these causes are communications that only go from teacher to students (1-way communications), poor presentation methods, and no clear communication standards. (Horn, 1994)

Interactivity involves developing techniques that will work within the confines of the medium (Lewis, 1996). Interviewed teachers said that their old methods of interactivity had to be modified with VTE compared to a live classroom. They mentioned that including visual variety, changing camera angles, and using short activities help in increasing interactivity with the students. One teacher said that the higher the degree of interactivity, the more support was required from a production perspective. One professor increased VTE interactivity by traveling one time to the remote site class to get to know the students there. (Interview, 1996)

Trainers at MCI and Hewlett- Packard claim that the One Touch System with the student response pad provides a way to increase interactivity. The system provides an interactive link. Because the teacher does not have the normal visual cues as defined by "interactivity," the One Touch System relies on the keypad for interactivity (Lewis, 1996; Markowitz, 1996). Trainers claim that when student audience size increases in a normal classroom, interactivity decreases; however, increasing student numbers with the One Touch System increases interactivity (Markowitz, 1996).

Lewis claims that the One Touch System allows the students to speak to other students at remote sites through microphones, become involved with them, have an enjoyable experience, and learn at the same time. He also claims that once they are accustomed to VTE, the students find themselves talking directly to the television. The instructor gets immediate feedback as well through administering pop quizzes on screen, and the assessing quiz results. (Lewis, 1996)

Although the overall teaching was considered effective, VTT was rated lower in the items pertaining to interaction and participation issues in one NPRDC study. Wetzel, Simpson and Seymour found that teaching NAVLEAD courses to Chief and Leading Petty Officers was successful using VTE as measured by student questionnaires despite

the problems with decreased interactivity. NAVLEAD has a highly interactive design that requires students to interact by making decisions, having positions of responsibility, and working as a team. (Wetzel, Simpson, Seymour, 1995)

F. TEACHING EFFECTIVENESS: COURSES WHERE VTE WORKS

VTE has been found to be effective for a wide variety of subjects and can be used with many teaching techniques; however, VTE is not effective with every type of course (Wetzel, Radtke, and Stern, 1994). Researchers differ regarding VTE applications for "hard" and "soft" skills. Some researchers have found that VTE is not recommended for "hard skills" but that it is good for "soft skills" (Hunter, 1995). Hard skills are defined as those with readily measurable learning outcomes, such as accounting. Soft skills are defined as those requiring more analysis and less concrete answers, such as interpersonal communications and leadership courses.

According to one researcher, VTE is not effective in situations that require direct coaching by an instructor or situations when highly charged emotional teaching occurs, such as diversity training (Lewis, 1996). Crawford and Suchan studied executive management education and media selection. They found that with executive management education, VTE may not provide the highly interactive environment that is required to achieve higher-level learning outcomes such as analyzing complex situations and changing habits of mind. They found that, "inappropriate technology-based pairings can undermine learning effectiveness, student satisfaction, and program credibility." (Crawford and Suchan, 1996)

Disagreements about VTE use between researchers occur in areas requiring complex psychomotor skills. Some researchers claim VTE will not be effective with motor skills like golf (Lewis, 1996). Yet in the area of creative arts such as learning to play the violin, one researcher claimed that VTE can be better than a live classroom (Foley, 1996). The report stated that violin students from all over the world receive personal instruction from a master violinist via VTE. The students derive as much value from 30 minutes of video training than what they would receive in an hour-long session of face-to-face instruction (Foley, 1996). The master violinist who teaches via VTE was interviewed and said,

> . . . to see yourself and the teacher on adjacent screens [has] much more immediacy, a real double whammy. You get objectivity and subjectivity all at the same time, which greatly enhances the teaching. The students get so much more. (Foley, 1996)

In the case of people who cannot attend live concerts or universities, the violin master claimed that interactive video can reach them and put them into music curricula for a low cost. (Foley, 1996)

Wetzel found that VTE works well for lecture-based courses and some laboratory courses, although some laboratory course situations prohibit using VTE. Those courses are ones:

- That need subject matter experts
- That have supervision and safety issues
- Where certification is critical and must be done by someone other than the facilitator
- Where the instructor needs to see the students
- Where full-scale equipment is needed
- Where computer needs cannot be met with portable computers
- Where cameras would restrict the laboratory experiences
- Where cost is prohibitive (Wetzel, 1996)

Another study evaluated the appropriateness of courses taught via VTE. Researchers found that demand for specific courses and stability of training material were both key factors in the decision of whether VTE could be used effectively (Bramble et al., 1994).

CNET has determined that courses that are less than one week long are good candidates for VTE (Bramble et al., 1994). One researcher found that resistance to VTE by students decreased over the week following the initial demonstration and that students became used to the equipment that the Navy adapted for VTE. After becoming acclimated to VTE, the students accepted it and learned to adjust. On the other hand, one

researcher pointed out that a Navy enlisted person will put up with anything (Griffin, 1995).

G. SUMMARY

VTE must be effective for it to be considered a reasonable choice for training delivery. Research reveals that methods of evaluating effectiveness are often unclear. Researchers have studied and reported on the cost effectiveness of VTE. They have examined learning outcomes, student learning experiences, and teaching effectiveness as well. Interactivity appears frequently in the literature without adequate definition and without clear suggestions of how to improve it with VTE. Decision-makers should consider all these aspects of effectiveness when evaluating whether to make the change from traditional classroom teaching to VTE. If decision-makers decide to adopt VTE, there are many changes that are necessary. These changes are presented in the following chapter.

IV. CHANGING REQUIREMENTS WITH VTE

Teachers, administrators, and students must make considerable changes when going from a traditional classroom environment to VTE. Not only does one have to become aware of the new physical environmental restrictions, but other issues also arise that may not have been problematic in a live classroom environment. Administrators and teachers must address the environmental changes and the limitations of VTE as well as production and delivery issues. Both students and teachers have numerous personal adaptations to make. This chapter addresses these issues. Wolcott stated that

> The reflective practitioner examines and questions the understanding that is at the foundation of his or her practice. . . .tries to make sense out of an uncertain or divergent situation by questioning assumptions, reframing the problem, and constructing and testing new approaches. (Wolcott, p. 39, 1995)

A. NEEDS ASSESSMENT

Researchers recommend performing a needs assessment to establish a foundation for the design of any training program. Wagner states:

> Needs assessment helps to define problems to be solved, identifies the constraints which may be encountered when attempting to solve a problem, identifies the people to be affected by anticipated changes, and provides project parameters within which to operate. (E. Wagner, 1993)

The needs assessment entails more than just analyzing the students' entry level behaviors and skills; one needs to know the skill levels of all personnel involved in the training. (E. Wagner, 1993) Without this information, there is no basis on which to plan the training evolution.

Some researchers have discovered that few organizations perform needs assessments prior to developing their VTE programs. (Needs Assessment for Distance Learning, n.d.) Since VTE brings with it technological challenges, not conducting a needs analysis could pose more problems than might be the case with traditional teaching.

B. INSTRUCTIONAL DESIGN

Instructional design is also critical to a successful VTE experience. (The Mitre Corporation, 1996) Although instructional design is important with traditional teaching, it becomes more so with VTE due to the technological requirements. Instructional design is what the teacher wants the student to be able to master as a result of the training and is stated in behavioral terms. (Lewis, 1995) Instructional design is "a systematic method of determining solutions for performance problems that arise from a knowledge or a skills deficiency." (E. Wagner, 1993) Madhumita states, "Instructional design should reflect the objectives, student abilities, and instructional media available." (Madhumita, 1995)

1. What is Involved in Instructional Design?

Moore and Kearsley suggest using a five-phase approach in instructional design. This approach involves analysis, evaluation, implementation, development, and design with each of the stages moving in a cyclic pattern in both directions (Moore and Kearsley, 1996). The general design principles are: good structure, clear objectives, small units, planned participation, completeness [thoroughness], repetition, synthesis, simulation, variety, open-ended assignments, feedback, and continuous evaluation (Moore and Kearsley, 1996).

Regarding course design and development, researchers pose a number of questions. According to Moore and Kearsley, some include:

- What content should you include?

- What is the best way to organize the material?

- Which media should you use?

- What teaching strategies are best?

- How do you measure learning?

- What feedback should you give students?

- What methods will you use to create materials? (Moore and Kearsley, 1996)

Several other researchers have stated important points to consider in instructional design. One researcher stated that one needs planning and delivery that is appropriate to

the medium. Some issues to include are: a skilled presenter who involves the audience, a plan to promote interactivity, the use of text material before and after the presentation, and good quality audio and video (The Mitre Corporation, 1995). Bramble found that instructional design needs to include

- An understanding of group dynamics
- Structuring of student involvement
- Lectures less than 20 minutes
- Adaptation of visual aids
- Planning for questions
- The need to involve and motivate learners
- The need to make an interactive guide. (Bramble et al., 1994)

Fetterman noted that instructors should design and structure modules for the time periods with prepared questions and discussions (Fetterman, n.d.).

Design principles change with VTE. Simpson mentions four design principles to consider when converting to VTE. They are: support interactivity, mimic live training, minimize personnel and support requirements, and minimize production complexity (Simpson, 1993).

Due to the distance between students and teachers and the technological requirements involved, VTE demands an even greater need for thorough instructional design than live classroom teaching. Research interviews conducted for this thesis revealed that teachers felt that while they could "wing it" with a live class, VTE required deliberate, careful management and planning of each minute of class time. The VTE environment does not allow for unplanned classroom teaching techniques and careless instructional design. (Interview, 1996)

2. Who performs instructional design?

Research shows that often the instructor not only designs the course but also provides to the student expertise, progress and feedback, counseling, and encouragement (Staten and Pemberton, 1995). Other research states that multimedia developers can help

VTE instructors (Hall, p. 62, 1996). With the complexity of designing courses conducted via VTE, the teacher may need to develop different skills or create a team of various experts to cover all areas of instructional design.

3. Development, Coordination and Other Challenges with Design

Development and coordination issues challenge VTE instructional design. Teachers may need more time to develop course materials due to the technological requirements of VTE. Coordination with administration and remotely located students presents a challenge. Additionally, the instruction design must include appropriate strategies and methods and include multiple chances for interaction. (Bramble et al., 1994)

Multiple training sites create more technical difficulties and challenges. For example, the teacher must coordinate the questions and needs of more than one group and facilitate discussion and interaction among groups geographically dispersed. (Mercer, 1995)

Instructional design team members need to focus on student interaction, appropriate student performance data, and objective evaluation items. (Bramble et al., 1994; Bailey et al., 1989) While these issues exist in live classroom teaching, VTE creates more complex relationships among students and teachers. With instructional design, one researcher stated that the challenge is "to marry television programming and effective curriculum planning." (Phillip, 1994).

Naidu found that a team approach to the process of material development is strongly recommended and often adopted with VTE. He said

> The development of high quality instructional materials for [VTE] is a labour intensive and costly affair, and draws upon a wide range of expertise that is not normally found in the repertoire of skills of any one person. (Naidu, 1994)

Coordinating activities at the distant site is one of the most challenging tasks that distance teachers must face (Moore and Kearsley, 1996). With live instruction, students and teachers are co-located and accessible to each other. Teachers can address questions and problems in the presence of the students. VTE does not allow students and teachers to meet after class time to discuss problems face-to-face.

In addition, both teachers and instructional designers need to be aware of the time between course design and delivery. Because VTE involves technological challenges, designers may need more time to develop course materials. Also administrative preparations for a VTE class could be more time-consuming. Consequently, a longer gap could exist between development and implementation of a VTE course. According to Portway,

> Between completion of course materials and delivery, a critical gap develops, sometimes as long as six months. The longer it lasts, the more likely it is that they [course materials] will be outdated before they can be delivered to the students. (Portway, 1993)

Challenges with VTE also involve human factors. Some of those factors required to make the transition to VTE are: simplicity of design, flexibility in the classroom, unbreakability of equipment, user control, information requirements, and transparency (Simpson, 1993). In addition, the instructional designer needs to think visually while keeping the technology invisible to the students (Fetterman, n.d.).

C. PHYSICAL PREPARATION AND SUPPORT

Physically changing the teaching environment is a consideration when using VTE. Although new buildings may not have to be built, there are changes to make on a smaller scale when teaching with VTE.

1. Buildings

While building considerations are as important in live teaching situations, the physical distance between the student and teacher with VTE can exacerbate last minute problems. Acoustics is an important consideration in all teaching environments and especially with VTE. One researcher stated that major structural changes to a building where VTE is being produced are not needed as long as there are good acoustics in the actual classroom. The studio should be in close proximity to the users, away from the elevator, without swivel or rocking chairs, and with matched furniture at all remote sites. Planners also need to be aware of easy access to bathrooms, water fountains, telephones,

and food. (Bailey et al., 1989) To save money on construction, some universities are sharing their building resources (Schultz, 1996).

2. Classroom

VTE demands some changes in the classroom physical environment. With classroom design, the walls should be non-reflective, neutral grays or browns, with no whiteboards (Bailey et al., 1989). In addition, teachers may have to modify the lighting in the classroom (Bailey et al., 1989; Diamond and Roberts, 1996; Mercer, 1995). The desired effect for the classroom environment is "a balanced contrast with shadows and highlights that looks comfortable with multiple evenly distributed light sources either with cool white or blue-white fluorescent bulbs" (Diamond and Roberts, 1996). The television monitors should be in the shadows (Diamond and Roberts, 1996).

One researcher included eight tips for setting up a room to broadcast VTE. They are:

- Do not use rooms with a lot of white or dark colors
- Rent a photographer's backdrop to use behind the table or podium
- Avoid bold carpets and upholstery
- Have no swivel chairs or those with casters
- Remove glassed and other framed objects
- Have name tags or tent cards for participants
- Display an easy-to-see clock
- Have back-up batteries if using wireless control units (Diamond and Roberts, 1996)

When demonstrations are conducted or large equipment is needed, designers must consider using a larger classroom and ensure that an appropriate number of power outlets is available (Wetzel, Radtke, Parchman, Seymour, 1996). Seating charts are helpful for 2-way video VTE (Mercer, 1995).

Research interviews revealed that VTE places physical limitations on the teacher. Since the teacher has to focus on the camera, flexibility of movement is limited. All

interviews revealed that teachers felt confined with VTE after spending years developing a personal style of movement that worked for them in the live classroom. VTE does not allow what one professor stated he does in a classroom. "I like to prance around and shuck and jive." (Interview, 1996)

3. Clothing and Personal Items

Certain clothing choices can enhance or detract from VTE. Colors can distract the students or be distorted due to technology. Colors to avoid include: black, white, red, plaids, checks, or herringbone. (Bailey et al., 1989; Diamond and Roberts, 1996) Good colors are: royal blue, purple, and burgundy for women, and blue or dark gray for men (Diamond and Roberts, 1996). Styles of clothing are also important. Wear simple, tailored suits or dresses in medium-dark colors, solid fabrics, pastel shirts and non-white blouses (Diamond and Roberts, 1996). Women should avoid scarves, ruffles, and fabrics that rustle because the sound may transmit and cause distractions. Some researchers recommend that teachers wear clothes that match the classroom walls (Diamond and Roberts, 1996). Men should not wear neckties with bold patterns or too many stripes (Bailey et al., 1989).

Women should wear little jewelry and avoid wearing large earrings, brooches and noisy bracelets. (Bailey et al., 1989; Diamond and Roberts, 1996) Women should avoid dark or bright lipstick, dark eye shadows, strong blush, and hairstyles that requires attention during broadcasting (Diamond and Roberts, 1996).

D. PRODUCTION AND DELIVERY ISSUES

There are numerous production and delivery issues to consider. They range from requirements for administrative support to equipment and technician needs. Production and delivery can be complex when first starting VTE. Yet once one makes adjustments for VTE and has sufficient practice, these issues become easier to accommodate.

One trainer mentioned several points to consider with production and delivery. They are: practicality of course and its content, local studio costs, remote site costs, and points of contact in the remote class to facilitate and manipulate the hardware.

(Markowitz, 1996) Some important considerations for implementing VTE are discussed next.

1. Administrative Support

Administrative support is important when conducting VTE, and there are several supportive actions administrators must take for VTE to succeed. Some of them are:

- Invest in a staff

- Provide instructor training

- Dedicate training for the production team

- Buy equipment based on organizational needs, not necessarily on price (Lewis, 1996)

Site facilitators are necessary at the remote site. The administration needs to be aware of this and provide for them in the budget (Bailey et al., 1989). Administrators who schedule training must be aware of the difference in time zones. (Bailey et al., 1989; Moore and Kearsley, 1996; Lewis, 1996) In traditional teaching, all students are located at the training site at the same time as the instructor. With VTE, if administrators are not aware of the time zone changes, they could schedule training times that would not be practical for students (Lewis, n.d.) .

Policy issues that administrators must be aware of at the local, state, and federal levels occur with implementation of VTE. Some of these issues are:

- Teacher credentialing

- Program accreditation

- Determining course equivalency

- Course offerings

- Conforming with local educational initiatives

- Quality assurance

- Budget decisions

- Scheduling, i.e., in the case of course completion dates and pace (Moore and Kearsley , 1996)

The administration also needs to provide access to course textbooks for students at remote sites (Interview, 1996).

Interviews revealed the importance of control and communication between the faculty and the administration. Teachers requested that the administration be supportive in many ways. This support includes providing a technician and all necessary equipment to help the teacher prepare. Teachers also mentioned that institutions need to provide funding in their budgets for the extra expenses that accompany VTE. (Interview, 1996)

Administrative support includes providing appropriate rewards for VTE teachers. Interviews revealed that several professors thought their school would be able to find faculty to do VTE because it is a new and interesting medium. However, since VTE requires more classroom preparation than traditional teaching, they felt the administration should provide more rewards, e.g., more time off, lighter course loads. Some professors stated that the faculty would become disillusioned if different rewards were not instituted for those teaching with VTE. (Interview, 1996)

2. Equipment Needs

VTE requires using equipment, which necessitates change on the part of the teacher. Traditional classroom teaching requires neither knowledge nor expertise with camera equipment whereas VTE demands some expertise. Regarding camera placement, research stated that cameras be placed below or above the main monitor to allow the teacher to look directly into it (Diamond and Roberts, 1996). Another important consideration is the use of preset close-up and zoom shots at appropriate distances from participants. Some camera needs with VTE could be:

- A flexible camera
- A tabletop video camera
- A pan/tile/zoom robot camera
- A robot tracking camera
- A video mixer to use two cameras

- A 35mm slide projector

- Portable cameras to use during demonstrations

- Automated camera systems

- Graphics and document cameras (Wetzel, 1996; Diamond and Roberts, 1996)

If the course involves laboratory work, other possible equipment consists of:

- Video microscope

- Manual switch box

- Equipment to use picture in picture (PIP) technology

- Portable system carts (Wetzel, Radtke, Parchman, Seymour, 1996)

VTE teachers need to understand how to work sound equipment. Microphones, placed near two to three participants, help students to be able to speak naturally to produce clear, undistorted sound. Speakers, placed near the students, aid in making the sound and picture look as if they come from the same place. (Diamond and Roberts, 1996)

Students can use cameras as well to get help from the teacher. One professor mentioned that the students used the technology to send back examples of their written work via the camera so that the teacher could see how they were doing. (Interview, 1996)

The main idea concerning cameras and sound equipment is that VTE always requires use of at least some technology that is new to the teacher where traditional classroom teaching does not demand that a teacher operate sophisticated photographic and sound equipment. Understanding the equipment requirements and becoming competent in using it are necessary for VTE teachers to be successful with the medium.

3. Technician Needs

Much of the research revealed the importance of having a facilitator at the remote site. (E. Wagner, 1993; Wetzel, Pugh, Van Matre, Parchman, 1996; Wetzel, Radtke, Parchman, Seymour, 1996; Bramble et al., 1994; Lewis, 1996; Markowitz, 1996)

Researchers found that facilitators play an important role as technical experts and administrative aids. (Wetzel, 1995)

Some military researchers showed that VTE requires three people: the Instructor Coordinator (IC), Military Instructor Assistant (MIA), and Military Site Coordinator (MSC). The IC works at the remote site and performs some of the off-line instructional role. The MIA operates the overhead camera and also delivers some of the material. The MSC is the instructor representative at the remote site and manages the instructional activities there along with the IC. (Bramble et al., 1994) The importance of the remote site facilitator for successful VTE appears throughout the literature (Wetzel, 1995).

Micro Communications Incorporated (MCI) uses the "One Touch System" described in Chapter II. The system requires that certain positions be staffed at all times. The required personnel who remain in the room during the entire broadcast are: the technical director, the Viewer Response System (VRS) person who runs the "One Touch System", and a graphic artist (Markowitz, 1996). There is a console and space for four instructors and six subject matter experts (SMEs) who are seated at a table and available for questions (Markowitz, 1996).

Some instructors do not have the luxury of having a technician available. One researcher developed a checksheet to determine if a technician is required during the broadcasting. The following issues should be addressed:

- Does the teacher know how to connect with remote sites?

- Is this a point-to-point session? (May require less expertise than multi-point)

- Can the teacher troubleshoot problems?

- Are there a minimum of peripherals?

- Is this an informal teaching course where the teacher knows participants well and can afford to make a few mistakes?

- Will there be time to devote to the camera, microphones, and switching?

- Can someone else can handle the camera, microphones, and switching?

- Does the budget allow for a technician?

- If no technician is available, is the teacher expected to work alone? (Diamond and Roberts, 1996)

4. Other Challenges

There are some global challenges of which the participants need to be aware. Some of these are shifts in time zones, language requirements and possible governmental restrictions on broadcasting (Lewis, n.d.).

Producing course materials, manuals, and books can also challenge personnel involved with VTE. MCI has each instructor create a highly graphical course book with bulletized lists and graphics to accompany each course. They found that graphics are better than words to aid students during VTE broadcasting. (Markowitz, 1996) Another researcher stated that site facilitators must have manuals available to them as well (Bailey et al., 1989).

Some teachers had problems providing books for students at the remote site. Research interviews revealed problems with their bookstore agreeing to order textbooks for remote site students. (Interview, 1996)

The research interviews revealed mixed opinions concerning whether or not to have a live class in addition to the distance class. One professor who had both remote and local students experienced groups who were "jealous of one another and attacking one another." Students made snide remarks about each other that were picked up by the microphones which necessitated teacher intervention. (Interview, 1996)

Giving equal treatment and equal time to different groups was a challenge for some of the interviewees. They noted that it was difficult to give equal attention to remote site students. (Interview, 1996) The only advantage one researcher found with having a local class was if there were locally available students who needed the training (Lewis, 1996). Other teachers felt that having at least some live students in the room helped them sense their effectiveness (Interview, 1996).

The interviews revealed a challenge in the area of examination administration. All professors had to coordinate examination materials at the remote site well ahead of the scheduled exam date and arrange for proctoring and exam control before, during, and after exam administration. Most professors simply proctored the exam from the remote site. In one situation, the professor had an on-site facilitator who proctored the exam once the students read through it. This allowed the professor to disconnect the line. Most professors remained available during exam administration for questions. (Interview, 1996)

5. How to begin?

If an organization is considering implementing VTE, there are production questions to consider. One experienced trainer recommended writing a detailed business plan. The plan includes researching other companies who have been successful with VTE. Case studies from some of the large corporations who use VTE (e.g., Xerox Corporation, Hewlett-Packard, Ford, Motorola, and Disney) can help in the research process. The case study information aids in justifying the expenses and costs to the company decision makers. (Markowitz, 1996)

E. STUDENT CHANGES

For VTE to be successful, the student must be flexible. Some of the changes that students encounter concern their attitudes. However, after students become acclimated to the medium, the changes are less noticeable. (N. Wagner, 1995)

Regarding the experiences of one professor who was interviewed,

> We [students and teacher] came in with an attitude that we should be very tolerant with the technology and that changed the whole ball game. [All understood that there would be technological problems]. I had the same attitude myself. (Interview, 1996)

The change in availability of teachers to students can influence students' attitude towards VTE. Interviews revealed that students do not have the same accessibility to teachers with VTE. Also, in order to compensate, it is necessary for teachers to provide access through the use of electronic mail and the telephone. (Interview, 1996)

Students' attitudes towards other students can be different with VTE since they may not have direct contact with other students. If the teacher requires them to interact and work with other remote students, students need to be open-minded for this be a positive experience and an effective teaching method. The students' attitudes toward working together and with the technology are important if VTE is to succeed. (Interview, 1996)

F. TEACHER CHANGES

Teacher changes are required for VTE. Traditional teaching will not work. (Thach and Murphy, 1995; Interview, 1996; Lewis, 1996)

Change can threaten some teachers. The complexity of VTE exacerbates that threat. Traditionalists who are asked to embrace distance education often see it as a threat not only to their classroom authority but to their job security (Schultz, p. 8, 1996). As a result of the technological changes associated with VTE, the following areas are important to understand:

- Teacher attitudes and expectations
- Necessary instructional skills
- Teaching materials
- Rehearsal
- Formal instruction.

1. Teachers' Attitudes and Expectations

Appropriate teacher attitudes and expectations are crucial for VTE to succeed. Research interviews revealed that VTE is not for every professor. "It can be exhausting for the instructors and boring for the students." (Interview, 1996) The teacher can feel a little like being on stage with no allowance for errors. For the teacher who prefers to use an extemporaneous ad-lib style and humor, and who does not like to do much advance preparation, the VTE experience may be negative. One professor remarked that he had to learn how to speak more slowly and use a different conversational rhythm due to the technological limitations of VTE. The time lag "buffered his and the students' innate sense of communication, and it felt unnatural." (Interview, 1996) One professor stated that he had to change his expectation of what a satisfactory classroom experience felt like with VTE. The VTE classroom differs in "feel, smell, [and] visualness [of] the experience. . .VTE is a cold experience." (Interview, 1996)

One researcher listed five questions a VTE teacher could ask to aid in identifying expectations. They are:

- What do I expect?

- What will change; what will not?

- Will my objectives work?

- What influences learning in this medium?

- How do I maximize the medium without minimizing its limits? (Wolcott, 1995)

One challenge for VTE teachers is knowing whether a class has gone well. Some professors felt that they could understand both the local and remote students' moods and comprehension of the material during the class. Other professors had only an off-site class to concentrate on and had difficulty determining if the class was a success. One interviewee stated that he had little or no information from the students, could not read their body language, and was unaware of how they were doing. "You are unaware of that [how students reacted]. You can feel fine, yet be missing something big. You can't tell if you have engaged the remote students so you have to work to engage them or solicit feedback." (Interview, 1996)

Some teachers have expectations about receiving different or additional rewards when teaching via VTE. Rewards, such as release time, formal and informal recognition, and salary increases present an issue to those teaching with VTE. One report stated that some educational cultural norms could result in teachers chosen for VTE being less than the best (Suchan and Crawford, 1995). Teachers need departmental and administrative rewards and acknowledgment when adding VTE preparation and execution to an already demanding schedule (Interview, 1996).

Teacher expectations and attitudes can prepare them for a rewarding experience with VTE. Their attitudes can also program them for failure. One professor summed up the experience with, "You have to love it or <u>don't</u> <u>do</u> <u>it</u>." (Interview, 1996)

2. What skills are necessary?

Researchers have noted that new skills are necessary for the teacher to succeed with VTE. Thiagarajan noted in 1978 that students can undergo "the loneliness of the long-distance learner" (Wolcott, 1995). This is due to less opportunity for instructor contact both in and outside of class and lack of contact with students at other sites (Wolcott, 1995). Student can sometimes feel isolated and like second class citizens

(Wolcott, 1995). Teachers need to develop new skills and mannerisms that are more congruent with a broadcast medium (Biacinto, 1995; Thach and Murphy, 1995). The skills should address the possible feelings of isolation and remote status of the student.

Teachers need to think about how adults learn since many students taught by VTE are adults. (Wolcott, 1995; Moore and Kearsley, 1996) Adult learners have to be persuaded that the course material is relevant to their needs. They are more self-directed and need to take personal responsibility for their learning. Adults also have personal experiences to draw upon in a learning environment. They are also usually more internally motivated than younger students in classroom environments. The teacher needs to approach VTE with these issues in mind. (Moore and Kearsley, 1996)

Teachers need to inform students of ways to communicate that are visible to the teacher. For example, teachers may even have difficulty seeing a raised hand, and they may not be able to see subtle shifts in body positions or facial expressions. (Interview, 1996)

While many teachers were trained to teach using a lecture format, VTE cannot be both solely lecture-based and effective (Davis and Murrell, 1993). One interviewee stated that doing the same activity on VTE for more than 10-15 minutes (e.g., speaking, reading, listening comprehension, short activities) could cause students to become bored (Interview, 1996).

Thach and Murphy conducted research to identify the roles and competencies of teachers who use distance learning in the United States and Canada (Thach and Murphy, 1995). While most of these roles and competencies are important for traditional teaching environments, three are more crucial for VTE. They are

- Knowledge of the distance education field
- Basic technological knowledge
- Technology access knowledge (Thach and Murphy, 1995)

Thach and Murphy's research developed a model that encompassed the roles, outputs, and competencies that experts in distance learning had identified. Associated with those competencies, they found eleven roles and aligned the roles with the competencies. Their results can serve as a research foundation for development training

and certification programs for distance education professionals. (Thach and Murphy, 1995) The roles they identified are:

- Instructor
- Instructional designer
- Technology expert
- Technician
- Administrator
- Site facilitator
- Support staff
- Editor
- Librarian
- Evaluation specialist
- Graphics designer (Thach and Murphy, 1995)

Figure 1 depicts the Distance Learning Roles and Key Competencies Model.

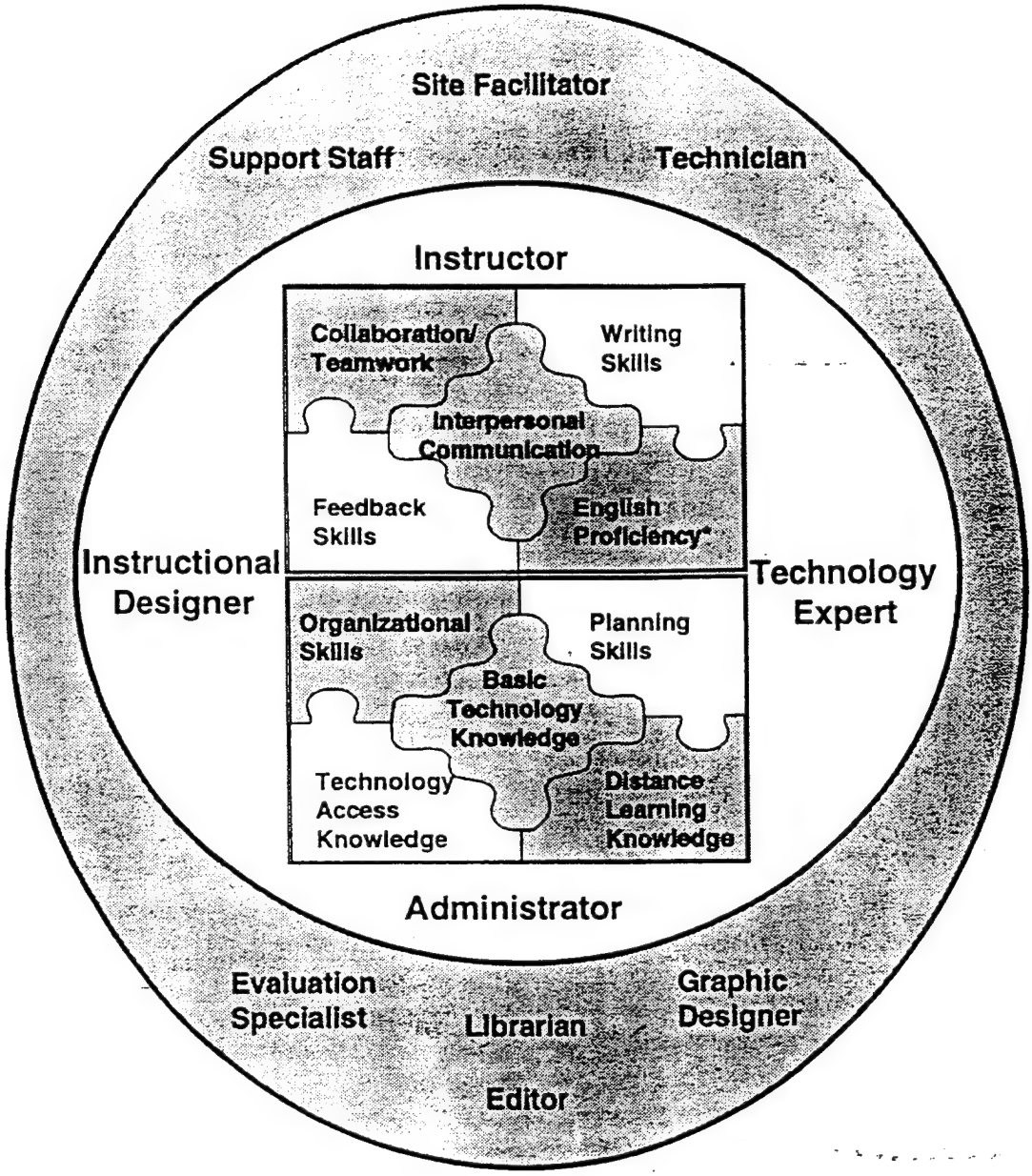

Figure 1. Distance Learning Roles and Competencies Model

Thach and Murphy also cite studies that stress the need for the instructor to know the technology, to appear competent in using it, and to know its impact on the student. They also state that VTE teachers may need to advise administrators regarding technology selection, technology effectiveness, and instructional advantages of VTE. (Thach and Murphy, 1995)

3. Teaching Materials

Interviews revealed that charts and graphs were the most frequently mentioned training aids that demanded instructor preparation time. (Interview, 1996; (Mercer, 1995; Bailey et al., 1989; Lewis, 1996; Moore and Kearsley, 1996). Teachers cannot use the same visual aids that are used in a traditional classroom. because they cannot always be seen with the VTE cameras. Remaking visual aids that will be visible with VTE takes time (Interview, 1996). One researcher suggested as a rule of thumb that visual aids be no smaller than 30 font, contain no more than a title and four bullets, and have no more than four words per bullet (Lewis, 1996).

Preparing teaching materials takes much more time than a live class preparation. Research interviews showed that instructors needed time to make extensive handout materials and sometimes to put course materials on the Internet. Course handouts helped students follow the lessons better and see the overheads if there were any problems with clarity during transmission. (Interview, 1996)

4. Rehearsal

Since the VTE medium is much more demanding and requires more time for the instructor to become comfortable with it, researchers stress the importance of practice and rehearsal sessions. (Rogers, 1994; Interview, 1996; Fetterman, n.d.) Interviewees stressed practicing with the equipment and the technology beforehand as well as talking with other experienced teachers (Interview, 1996).

5. Formal instruction for the VTE Teacher

Since VTE is a new challenge for teachers, research shows that VTE training can help. Training varies from several hours to two-week long seminars (Suchan and Crawford, 1995). While some teachers receive no extra training and have to train themselves, others receive formal training through their employers. Appendix C lists some sites where VTE teacher development is conducted and what courses are involved.

6. Summary

Researchers have described changes accompanying VTE and the ways to increase teacher confidence and competence for a successful VTE experience. The importance of performing a needs assessment is heightened with VTE. Instructional design involves others besides the teacher and presents challenges in the areas of development, coordination, and offsite communication. Administrators need to be aware of the environmental demands of VTE on teachers and students. Teachers need to adapt the classrooms for VTE and pay more attention to their own clothing choices. Teachers must practice with the equipment. By incorporating necessary changes and increasing technological skills, all personnel should be able to make a successful transition to VTE.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Distance learning has progressed from correspondence courses to videoteleducation, the training method of choice for many private corporations, federal agencies, and educators to provide just-in-time learning to employees. According to Hezel Associates,

> Telecommunications is no longer viewed as an add-on garnish to the usual fare of education--teachers and administrators recognize that telecommunications is now an essential ingredient to making students smarter and more information rich. Demographic shifts in the student population, especially in Florida, Texas, and California, are creating an urgency about new ways to deliver education among burgeoning and widely dispersed populations. (Hezel Associates, 1996)

Researchers are not always definite in their use of terminology. Confusion results by interchanging the terms videoteleducation, videteletraining, videoteleconferencing, and distance learning. This confusions makes it difficult to understand and evaluate effectiveness studies.

Many organizations state that VTE is an effective training medium although, in many cases, effectiveness claims have not been substantiated by objective criteria and in some cases evaluation methods were not discussed. Some researchers warn that much VTE effectiveness evidence is anecdotal and that many distance education researchers have limited resources at their disposal. They claim that the research lacks a theoretical framework and, therefore, question its effectiveness. (Moore and Kearsley, 1996)

Cost-effectiveness studies have shown that VTE may save dollars through reduced travel and per diem costs. However, production, equipment purchase, and rental costs must be factored in when assessing cost effectiveness. Trainers should examine their own training needs and perform a cost analysis before committing their organizations to VTE.

The incorporation of VTE into teaching methodologies causes changes. These changes can be in the following areas: instructional design, physical, administrative and technological support, production facilities, and student/teacher preparation. The

transition from a live classroom to VTE requires teachers and administrative support personnel to develop new skills.

Researchers differ in their recommendations about the kinds of courses that are most appropriate for VTE. Some have found they could not recommend VTE for "hard skills," but that it was effective for teaching "soft skills." Others have found VTE less effective than traditional instruction in situations that require direct coaching by an instructor or situations when highly charged emotional learning occurs, e.g., diversity training. Additionally, VTE may not provide the highly interactive environment necessary to achieve higher-level learning outcomes, and there are disagreements about VTE use for teaching complex psychomotor skills. Nonetheless, VTE appears to have widespread applicability in the military as well as in other federal agencies, educational institutions, and private corporations.

One of the most important keys to VTE effectiveness is interactivity. Without interactivity, the VTE experience can be reminiscent of watching television. There are both 1-way and 2-way video systems that attempt to facilitate and encourage interactivity. Without interactivity, VTE success may not be as great.

With the budget constraints of the past several years and the gloomy outlook for travel dollars in the future, VTE may help solve some of the Navy's training needs. With the improvement of technology and decline of defense dollars, VTE may be the way to reach those for whom training and education would have been an impossibility.

B. RECOMMENDATIONS

This research leads to the following recommendations:

1. More research into VTE is necessary. Researchers often make claims that are unsubstantiated by quantitative data.

2. Researchers must differentiate among the terms distance learning, videoteleducation, videoteletraining, and videoteleconferencing. More differentiation among those terms would help clarify misunderstandings. Since distance learning encompasses other aspects besides VTE, careful use of the terms will give decision-makers the insight they need to make the right decisions for their organization.

3. Consolidating VTE assets is one way to increase cost effectiveness. Consideration of joint educational and training initiatives, especially among Department of Defense organizations, could achieve this.

4. CNET should consider further study into the issue of interactivity: specifically, what interactivity means, what is entailed, and how to increase it .

5. Measures of effectiveness and desired learning outcomes should be stated clearly in future evaluations of VTE.

6. Decision makers should consider all aspects of effectiveness when evaluating whether to make the change from traditional classroom teaching to VTE, e.g., cost, learning outcomes, teaching effectivess. Decision makers must exercise caution when evaluating VTE effectiveness claims.

7. Policy makers need to develop policies that look at distance education and VTE from a systems point of view. Subsequently, teachers need to be trained to work as specialists within that system. (Moore and Kearsley, 1996)

Training methods will continue to change over the years as technology changes. Further research into VTE and effectiveness claims will provide a clearer sense of what VTE can do for an organization.

APPENDIX A

QUESTIONS FOR PROSPECTIVE VTE USERS

A. WHO - STUDENTS

- Who is your audience?
- What are their interests/ needs?
- How many trainees are there, and how often do they need training?
- What is their background?
- How big is your audience?

B. WHO- TEACHERS/PROVIDERS

- Who develops training?
- Who provides training? Contractor? In-house?
- Are there remote site experts?
- What are other staffing needs?
- Who provides technical support?
- Who repairs equipment?
- Who is the remote point of contact?
- Who sets up the equipment?
- Can instructors travel?

C. WHAT

- What are the learning objectives?
- What training package are you using?
- Is the training offered elsewhere?
- What do you need for registration materials?

D. WHEN

- When is the training?
- How much time do you have to prepare?
- What time zones are involved?
- Will you repeat the course?

E. WHERE

- Where will you hold class?
- How big is the classroom?
- Are acoustics adequate?
- Do you have telephone access?
- Is there a reception area for students?
- Is there a centralized regional location for the students?

F. HOW - TEACHING

- How are you getting course materials to the students?
- What is your training method? Inform? Educate? Motivate? Train?
- Do you want high impact or simple style?
- How will you secure classified materials?
- How will you administer exams?
- How will you provide feedback to students?
- How will you evaluate training effectiveness?
- How will you evaluate students?

G. HOW- PRODUCTION

- How will you communicate?
- How will you handle obstacles in technology?
- What technology will you use?
- Will you buy or lease?
- What is your budget?
- What is the cost? Local? Remote?

H. WHY

- Why are you doing the training?
-What is in it for your organization?
- Does it have to be VTE?

APPENDIX B

WHERE TO GO FOR INFORMATION

- US Distance Learning Association
- US Air Force Extension Course Institute
- Distance Education and Training Council (DETC)
- National Technological University (NTU)
- National University Teleconferencing Network (NTU)
- *Satellite Learning* (TV guide-like magazine)
- Mind Extension Univerisity
- Westcott Univeristy
- Univeristy of Missouri Satellite Educaitonal Programming Guide
- National Distance Learning Center
- Oregon State Satellite Program Calendar

APPENDIX C

SITES THAT CONDUCT VTE TEACHER PREPARATION

The University of Wisconsin at Madison conducts a Professional Development Certificate in Distance Education. The program includes: conceptual framework of distance education, relevant technology, instructional design evaluation, and learner support systems. Other schools that offer certificates for distance learning contain the following subjects: design fundamentals, visual and graphics, strategies for interactivity, assessment, and independent study. There are also courses in comparative evaluation, hands-on training, planning production, evaluation, policy management, independent projects, adapting traditional courses, building a distance learning team, and classroom management of the remote site. Another course offers instructional design, software, video production, and editing. (Needs Assessment for Distance Learning, n.d.)

The University of Wyoming has a development plan for VTE teachers that includes a screen test, discussions, coaching, workshops, and seminars. A teacher training program at the University of Oregon contains training in personal performance, establishing rapport, the use of questioning strategies, course design, and visual preparation. (Suchan and Crawford, 1995)

Hewlett-Packard (HP) conducts 2 workshops for new VTE teachers. The workshops are customized for each company. First, HP performs a needs analysis, then conducts a 4-day workshop, then the teacher is ready to broadcast. HP also conducts 3 to 4 1/2 days of basic instruction training depending on how many iterations the company wants to do of the final product. This comes as part of the training and allows for no longer than 4 hours across time zones. Teachers also sit in the students' seats during training to see how it feels. Training includes focus on graphics and graphics design. (Lewis, 1996)

HP's Information Technology Education Network (ITE-Net) is available as well to help those who are instructing via VTE. The system has a touch screen video display that is fully integrated. The system allows the user to control cameras, videotape troll-ins, drawing tables, and stored graphics (Portway, 1993). HP sells its experience and

knowledge to others. Some of their clients have been Northern Telecom, Xerox, Ford Motor Company, and the US Department of Energy. (Lewis, 1994)

MCI has a 1 1/2 day Train the Trainer course that acclimates the teacher to the technology of the One Touch system. The training includes having the teachers make presentations to become used to the medium and prepare themselves for the camera. (Markowitz, 1996)

NPRDC developed a videotape to train new instructors in VTT within the Chief of Naval Education and Training Electronic Schoolhouse (CESN). The videotape entitled Videoteletraining Instructor Training is 21 minutes long, covers preparation of materials, remote-site coordination, and instructor behaviors. NPRDC also developed a VTT laboratory at the Fleet Training Center in San Diego to conduct VTT research. (Wetzel, 1996)

The US Army advises instructors to practice one iteration of an entire course. New VTE instructors at DLI receive a 2-week introductory course to prepare for VTE. (Suchan and Crawford, 1995)

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